JEE ADVANCED-2018

CHEMISTRY

1. **Sol. (B,C)**

(A) NH_4NO_3 (decompose below $300°C$ to produce N_2O & H_2O, but to produce N_2, it should be heated above $300°C$).

(B) $(NH_4)_2Cr_2O_7$

(C) $Ba(N_3)_2 \xrightarrow{\Delta} Ba + N_2$

(D) Mg_3N_2 (an ionic compound; will not decompose below $300°C$)

2. **Sol. (B,C)**

$\Rightarrow Fe(CO)_5$: Total number of valence electrons is 18
: low spin complex.

$\Rightarrow Ni(CO)_4$: Total number of valence electrons is 18
: low spin complex.

$\Rightarrow$ Metal-carbonyl bond strengthens when the oxidation state of metal is lowered.

$\Rightarrow$ The carbonyl $C-O$ bond is stronger in case of increased oxidation state of metal.

3. **Sol. (A, B, C)**

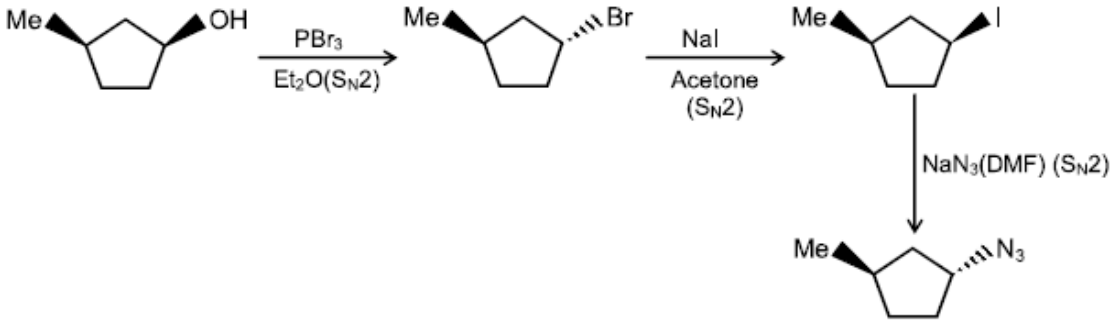
$\Rightarrow$ Bi_2O_5 is more basic than N_2O_5

$\Rightarrow$ NF_3 is more covalent than BiF_3

$\Rightarrow$ NH_3 boiling point is higher than PH_3

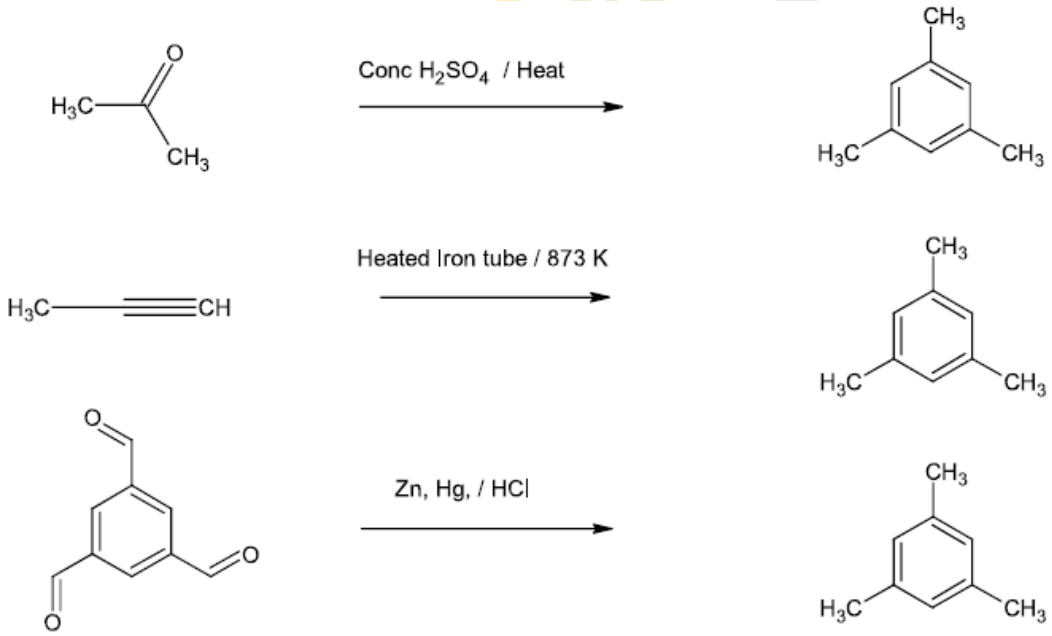
$\Rightarrow$ P–P single bond is stronger than N–N single bond.

4. **Sol. (B)**



5. **Sol. (A,B,D)**

Detail mechanism of mesitylene formation from acetone can be found in our video solution by SM Sir, HOD Chemistry Resonance.



6. **Sol. (B,C)**

$AC \Rightarrow$ isochoric process

$AB \Rightarrow$ isothermal process

$BC \Rightarrow$ isobaric process

$\Rightarrow q_{AC} = \Delta U_{AC} = nC_{v,m}\left(T_2 - T_1\right) = \Delta U_{BC}$

$\Rightarrow W_{AB} = -nRT_1 \ell n\left(\frac{V_2}{V_1}\right)$

$\Rightarrow W_{BC} = -P_2\left(V_1 - V_2\right) = P_2\left(V_2 - V_1\right)$

$\Rightarrow q_{BC} = \Delta H_{BC} = nC_{P,m}\left(T_2 - T_1\right) = \Delta H_{AC}$

$\Rightarrow \Delta H_{CA} = nC_{P,m}\left(T_1 - T_2\right)$

$\Rightarrow \Delta U_{CA} = nC_{v,m}\left(T_1 - T_2\right)$

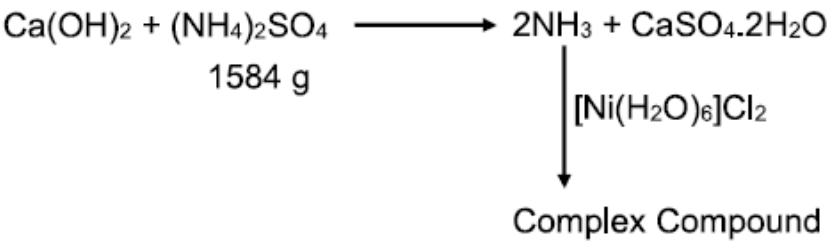
$\Delta H_{CA} < \Delta U_{CA}$ since both are negative $\left(T_1 < T_2\right)$

7. **Sol. 1**

Paramagnetic: $Mn_3O_4, \left(NH_4\right)_2\left[FeCl_4\right], \left(NH_4\right)_2\left[NiCl_4\right], K_2MnO_4$

Diamagnetic: K_2CrO_4

8. **Sol.** 2992



Number of Moles of $\left(NH_4\right)_2 SO_4 = \frac{1584}{132} = 12$ moles

Moles of NH_3 released $= 24$ moles

Moles of moles of $NiCl_2 \cdot 6H_2O = \frac{952}{238} = 4\,\text{moles}$

Number of moles of Gypsum $\left(CaSO_4 \cdot 2H_2O\right)$ formed $= 12\,\text{moles}$

Mass of Gypsum formed $= 12 \times 172 = 2064$

Number of moles of complex formed $\left[Ni\left(NH_3\right)_6\right]Cl_2 = \frac{24}{6} = 4\,\text{moles}$

Mass of complex formed $= 4 \times 232 = 928\,\text{g}$

Total Mass $= 2064 + 928 = 2992\,\text{g}$

9. **Sol. 3**

As per given information cation form FCC lattice and anion occpy all the actahedral void.

So	M^+	X^-	&	Formula MX
	4 ion	4 ion		
After step *I*	4 ion	1 ion		
After step *II*	1 ion	4 ion		
After step *III*	0 ion	4 ion		
After step *IV*	1 ion	3 ion		

So ratio of $\frac{\text{No. of anion}}{\text{No. of cation}} = \frac{3}{1}$

10. **Sol. 10**

$$Mg \rightarrow Mg^{2+} + 2e^-$$
$$Cu^{2+} + 2e^- \rightarrow Cu$$

$$Mg + Cu^{2+} Mg \rightarrow Mg^{2+} Cu$$

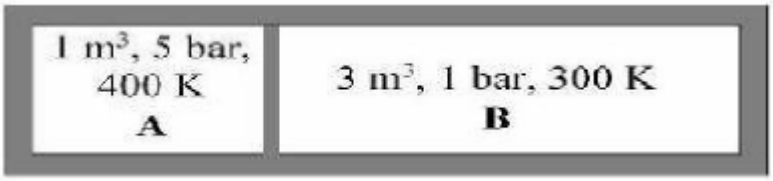
$$E = 2.67 = 2.7 - \frac{RT}{nF} \ell n \frac{x}{1}$$

$$0.03 = \frac{300}{2 \times 11500} \ell nx$$

$$2.3 = \ell nx$$

$$X = 10$$

11. **Sol.**



Finally, $P_A = P_B$ also $T_A = T_B$

So $\frac{n_A}{n_B} = \frac{V_A}{V_B}$

$$\frac{\frac{5}{400R}}{\frac{3}{300R}} = \frac{V_A}{V_B} \Rightarrow \frac{V_A}{V_B} = \frac{5}{4} \Rightarrow V_A = \frac{5}{9} \times 4 = \frac{20}{9} = 2.22$$

12. **Sol. 19**

$$p_T = p^o{}_A X_A + p^o{}_B X_B$$
$$45 = 20(0.5) + P_B^o(0.5)$$
$$P_B^o = 70$$
$$22.5 = 20X_A + 70(1 - X_A)$$
$$50X_A = 47.5$$
$$X_A = \frac{47.5}{5} = 0.95$$
$$X_B = 0.05$$
$$\frac{X_A}{X_B} = 19$$

13. **Sol. 4.47**

$$AB \rightleftharpoons A^+ + B^-$$

solubility x x $x - y$

$2\times10^{-10}=x(x-y)\quad\ldots(1)$

$B^-+H^+\rightleftharpoons HB$

$x-y10^{-3}\quad y$

$10^8=\dfrac{y}{(x-y)10^{-3}}$

$\dfrac{y}{x-y}=10^5$

$x-y=10^{-5}y\qquad\ldots(2)$

From (1) & (2)

$2\times10^{-10}=x^2-2\times10^{-5}$

$x^2=2\times10^{-5}$

$x=\sqrt{20}\times10^{-3}$

$=4.47\times10^{-3}$

14. **Sol.** 0.05

$2=2(K_b)_x\,m$

$1=2(K_b)_y\,m$

$\dfrac{(K_b)_x}{(K_b)_y}=2$

$\Delta(T_b)_x=\left(1-\dfrac{\beta}{2}\right)(K_b)_x\,m\quad\ldots(1)$

$\Delta(T_b)_y=\left(1-\dfrac{0.7}{2}\right)(K_b)_y\,m\quad\ldots(2)$

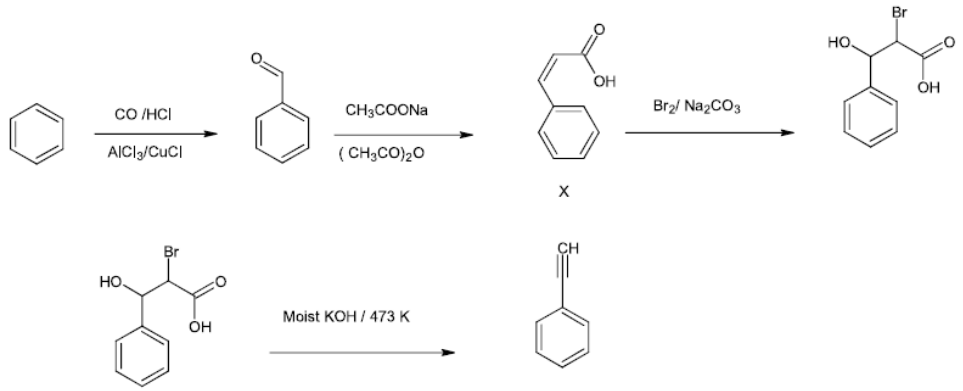
On taking the ratio of eq. no. (1) & (2)

$\Rightarrow 3=\dfrac{1-\dfrac{\beta}{2}}{0.65}\times2$

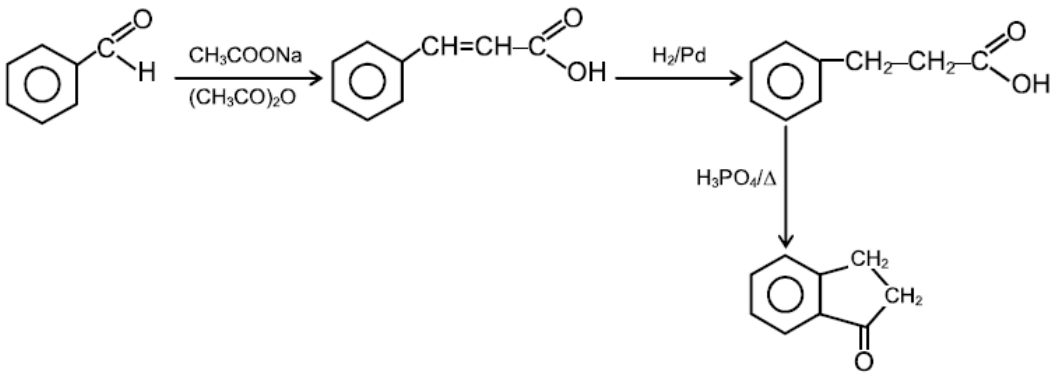
$1-\dfrac{\beta}{2}=1.5\times0.65$

$\beta=0.05$

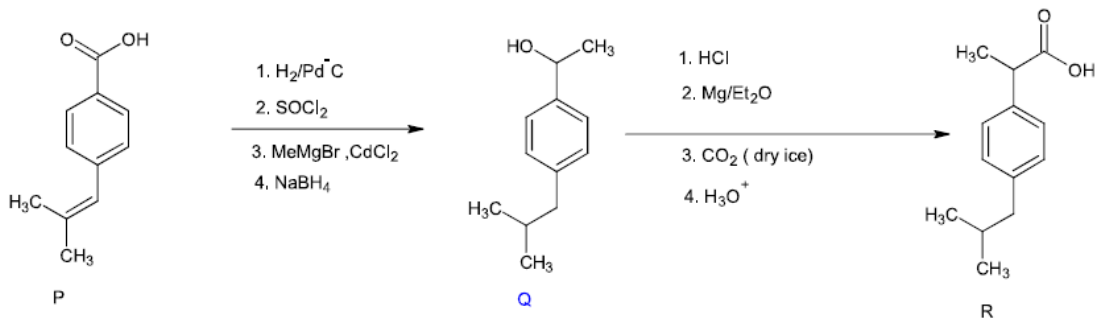
15. Sol. C



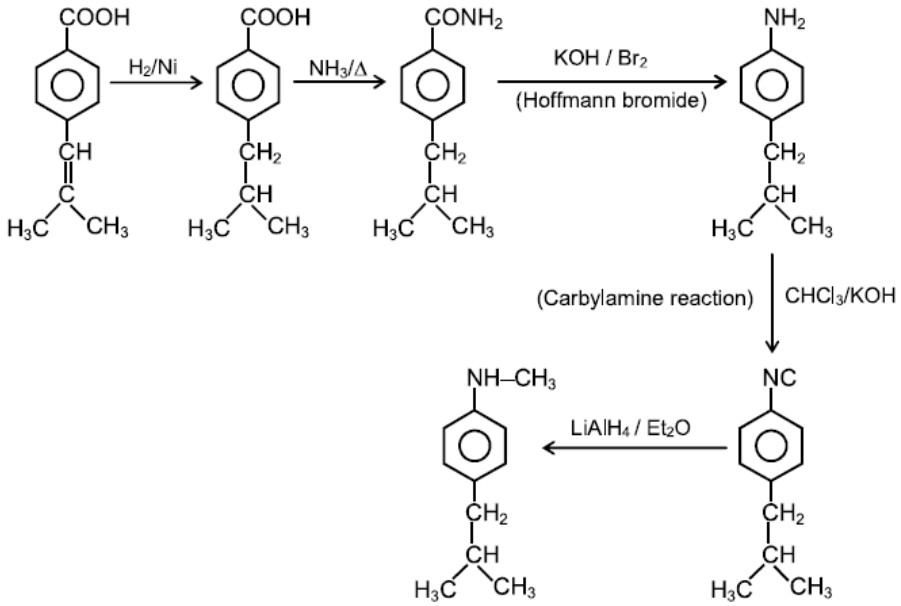
16. Sol. A



17. Sol. (A)



18. **Sol. (B)**


COOH
H2/Ni
COOH
NH3/Δ
CONH2
KOH / Br2
(Hoffmann bromide)
NH2
(Carbylamine reaction)
CHCl3/KOH
NH–CH3
LiAlH4 / Et2O
NC